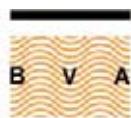


BROWN, VENCE & ASSOCIATES

Appendix B

Financial Evaluation of Alternatives



Animal Waste Project
Table 1: Alternative 1
Most Conservative Design Parameters

Items		Cost/SF
A Retention Ponds		Cost/SF
Capital Costs	1 Primary liner consistent with Title 27 Class II Surface Impoundments GM (40-mils thick synthetic liner or at least 60-mils thick if the liner consists of HPDE)	\$0.50
	Leachate Collection and Removal System Layer	\$0.50
	Leachate Collection and Removal System: Sumps and Pumps (\$20,000 for 2 sumps & 2 pumps)	\$0.10
	Second composite liner over GM/Compacted Clay Liner @ 1x10-7 cm/sec (at least 2 ft thick) or a GM/GCL @ 1x10-9 cm/sec	\$1.00
	2 Two foot minimum operations layer (local natural material) \$2/CY (geosynthetic cushion assumed not necessary)	\$0.15
	3 CQA Procedures (10% of capital costs)	\$0.12
	4 Install Groundwater Monitoring Wells (2 wells @ \$3,947.50 each)	\$0.04
Operational Costs	5 Annual Maintenance Removal of solids/contaminant source (2 ft) (Assume no additional costs since it is already necessary as a part of normal operations and maintenance.)	\$0.00
	6 Monitor of Groundwater wells (2 well samples and testing @\$250 each)	\$0.01
	7 Monitor of Vadose Zone (2 samples & lab testing @ \$175 each)	\$0.01
	8 Closure Removal of Liner (\$4/CY)	\$0.30
Closure Costs	Subliner soil removal: evaluate major ions concentrations in soil and excavate (not necessary if geosynthetic lined or no evidence of leakage). Removal of 2 ft of soil below retention pond. (Assumed not necessary.)	\$0.00
	9 Closure Testing (Soil testing for major ions: 4.4 acres with 2-3 samples/acre=10 samples and tests @ \$280 each)	\$0.01
B Corrals		Cost/SF
Capital Costs	1 Composite liner: low permeability barrier layer consistent with retention pond secondary composite system. GM/Compacted Clay Liner @ 1x10-7 cm/sec (at least 2 ft thick) or a GM/GCL @ 1x10-9 cm/sec	\$1.00
	2 CQA Testing during installation of low permeability layer (10% of capital costs)	\$0.12
	3 Two foot minimum operations layer (local natural material) (geosynthetic cushion assumed not necessary)	\$0.15
	4 Install Groundwater Monitoring Wells (2 wells @\$3,947.50 each)	\$0.02
Operational Costs	5 Remove manure (source) two times a year @\$3 per CY (2 ft)	\$0.11
	6 Monitor of Groundwater wells (2 wells @\$250 each)	\$0.01
	7 Monitor of Vadose Zone (2 samples & lab testing @ \$175 each)	\$0.01
Closure Costs	8 Closure Removal of operations layer/manure (2 ft layer @ \$3 per CY)	\$0.22
	Test soil for major ions content (13 acres with 2 samples/acre=26 samples and tests @ \$280 each)	\$0.02
	(If concentrations represent a threat to groundwater, excavate 2 ft of below operations/manure layer) Assumed not necessary.	\$0.00
C Milk Parlors		Cost/SF
Capital Costs	GM (40-mils thick synthetic liner or at least 60-mils thick if the liner consists of HPDE) Cost reflects the material cost plus the complexity of installing the material in milk parlors	\$0.75
	Concrete water-proof surface treatment (2 coats)	\$1.01
	2 CQA testing of concrete during installation (10% of capital costs)	\$0.18
Operational Costs	3 Annual Maintenance to fill cracks and Inspection of concrete surface (Annual concrete slab cost of \$0.05 plus the capital costs divided by 40 years of operation)	\$0.10
Closure Costs	4 No closure costs.	\$0.00

**Alternative 1 Net Present Value
Most Conservative Design Parameters**

Items	Year	Net Present Value									
		1	2	3	4	5	6	7	8	9	10
A Lagoon/Retention Ponds											
Capital Costs											
1 Primary liner consistent with Title 27 Class II Surface Impoundments GM (40-mils thick synthetic liner or at least 60-mil thick if the liner consists of HDPE)	\$0.50	192,401	\$86,201								
Leachate Collection and Removal System Layer	\$0.50	192,401	\$86,201								
Leachate Collection and Removal System, Sumps and Pumps \$20,000 for 2 sumps & 2 pumps	\$0.10	1	\$20,000								
Second composite liner over GM/Compacted Clay Liner @ 1x10-9 cm/sec (at least 2 ft thick) or a GM/GCL @ 1x10-9 cm/sec	\$1.00	192,401	\$192,401								
2 Two foot minimum operations layer (local natural material) \$2/CY (geosynthetic cushion assumed no necessary)	\$0.15	192,401	\$28,860								
3 COA procedures (10% of capital costs)	\$0.12		\$2,316								
4 Install Groundwater Monitoring Wells (2 wells @ \$3,947.50/each)	\$0.04	1	\$7,900								
5 Annual Maintenance											
Removal of solids/contaminant source (2 ft) (Assume no additional costs since it is already necessary as a part of normal operations and maintenance)	\$0.00	192,401									
6 Monitor of Groundwater wells (2 wells samples and testing @ \$8250 each)	\$0.01	1	\$2,060								
7 Monitor of Vadose Zone (2 samples & lab testing @ \$17.5 each)	\$0.01	1	\$1,442								
8 Closure											
9 Removal of liner (\$40CY)	\$0.30	192,401									
Closure Costs											
Subliner soil removal: evaluate major ions concentrations in soil and excavate (not necessary if geosynthetic lined or no evidence of leakage). Removal of 2 ft of soil below retention pond. (Assumed not necessary)	\$0.00	192,401									
9 Closure Testing, Soil testing for tritium, 4.4 acres with 3 samples/acre=10 samples and tests @ \$280 each)	\$0.01	1	\$3,502								
B Corals											
Capital Costs											
1 Composite liner, low permeability barrier layer consistent with retention pond secondary composite system.	\$1.00	563,494	\$563,494								
GM/Compacted Clay Liner @ 1x10-9 cm/sec (at least 2 ft thick) or a GM/GCL @ 1x10-9 cm/sec	\$0.12	1	\$65,487								
2 COA Testing during installation of low permeability liner (10% of capital costs)	\$0.15	563,494	\$83,481								
3 Two foot minimum operations layer (local natural material) (geosynthetic cushion assumed no necessary)	\$0.02	1	\$7,900								
4 Install Groundwater Monitoring Wells (2 wells @ \$3,947.50/each)	\$0.11	563,494	\$64,489								
5 Remove manure source two times a year @ \$3,947.50/CY (2 ft)	\$0.01	1	\$6,423								
6 Monitor of Groundwater wells (2 wells @ \$8250 each)	\$0.01	1	\$2,060								
7 Monitor of Vadose Zone (2 samples & lab testing @ \$17.5 each)	\$0.01	1	\$1,442								
8 Closure											
9 Removal of operations layer/manure (2 ft layer @ \$3/ton CY)	\$0.22	563,494									
Closure Costs											
Test soil for microbes content (13 acres with 2 samples/acre=26 samples and tests @ \$280 each)]	\$0.02	1	\$63,494								
If concentrations represent a threat to groundwater, excavate 2 ft of below operations/manure layer. Assumed not necessary.	\$0.00	563,494									
C Milk Parlors											
Capital Costs											
1 GM (40-mils thick synthetic liner or at least 60-mils thick if the liner consists of HDPE) Cost reflects the material	\$0.75	2,817,474	\$720,382								
Concrete waterproof surface treatment (2 coats)	\$0.01	9,087	\$68,227								
COA testing of concrete during initialization (10% of capital costs)	\$0.18	1	\$1,178								
Annual Maintenance to fill cracks and inspection of concrete surface (Annual concrete slab costs of \$0.05 plus the capital costs divided by 40 years of operation)	\$0.10	9,087	\$921								
Closure Costs											
1 No closure costs.											
** Note: The Size column refers to a lump sum or percentage that are one time costs.											
Total Area:	4,393,953	\$17,593	\$949	\$977	\$1,006	\$1,037	\$1,068	\$1,100	\$1,133	\$1,167	
Net Present Value :	\$2,940,000										
Assumption: Inflation at: 3%											
Discount rate for NPV: 5%											

**Alternative 1 Net Present Value
Most Conservative Design Parameters**

Items	Year	Net Present Value									
		11	12	13	14	15	16	17	18	19	20
A Lagoon/Retention Ponds											
Capital Costs		Cost/SF	Size** SF	Operations							
1 Primary liner consistent with Title 27 Class II Surface Impoundments GM (40-mils thick synthetic liner or at least 60-mile thick if the liner consists of HDPE)	\$0.50	192,401									
Leachate Collection and Removal System: Sumps and Pumps (\$20,000 for 2 sumps & 2 pumps)	\$0.50	192,401									
Leachate Collection and Removal System: Sumps and Pumps (\$20,000 for 2 sumps & 2 pumps) (at least 2 ft thick) or a GM/GCL @ 1x10-9 cm/sec	\$0.10	1									
Second composite liner over GM/Compacted Clay Liner @ 1x10-7 cm/sec (at least 2 ft thick) or a GM/GCL @ 1x10-9 cm/sec	\$1.00	192,401									
2 Two foot minimum operations layer (local natural material) \$32/CY (geosynthetic cushion assumed no necessary)	\$0.15	192,401									
3 COA Procedures (10% of capital costs)	\$0.12	1									
4 Install Groundwater Monitoring Wells (2 wells @ \$3,947.50/each)	\$0.04	1									
5 Annual Maintenance											
Removal of solids/contaminant source (2 ft) (Assume no additional costs since it is already necessary as a part of normal operations and maintenance)	\$0.00	192,401									
6 Monitor of Groundwater wells (2 wells samples and testing @ \$8250 each)	\$0.01	1	\$1,344	\$1,426	\$1,469	\$1,513	\$1,558	\$1,605	\$1,653	\$1,702	\$1,754
7 Monitor of Vadose Zone (2 samples & lab testing @ \$17.5 each)	\$0.01	1	\$941	\$969	\$988	\$1,028	\$1,059	\$1,091	\$1,123	\$1,157	\$1,192
8 Closure											
9 Removal of liner (\$40CY)	\$0.30	192,401									
Closure Costs											
Subliner soil removal: evaluate major ions concentrations in soil and excavate (not necessary if geosynthetic lined or no evidence of leakage). Removal of 2 ft of soil below retention pond. (Assumed not necessary.)	\$0.00	192,401									
10 Closure Testing: Soil testing for triturations: 4.4 acres with 3 samples/test=10 samples and tests @ \$280 each)	\$0.01	1									
11 Closure Testing: Soil testing for triturations: 4.4 acres with 3 samples/test=10 samples and tests @ \$280 each)	1,539,216	\$2,285	\$2,353	\$2,424	\$2,497	\$2,571	\$2,649	\$2,728	\$2,810	\$2,894	\$2,981
B Corrals											
Capital Costs											
1 Composite liner: low permeability barrier layer consistent with retention pond secondary composite system.	\$1.00	563,494									
2 COA Testing during installation of low permeability liner (10% of capital costs)	\$0.12	1									
3 Two foot minimum operations layer (local natural material) (geosynthetic cushion assumed not necessary)	\$0.15	563,494									
4 Install Groundwater Monitoring Wells (2 wells @ \$3,947.50/each)	\$0.02	1									
5 Remove mature source (two times a year @ \$3,947.50/each)	\$0.11	563,494	\$84,143	\$89,667	\$93,207	\$97,545	\$101,704	\$105,496	\$109,271	\$113,495	\$116,592
6 Monitor of Groundwater wells (2 wells @ \$250/each)	\$0.01	1	\$1,344	\$1,364	\$1,426	\$1,469	\$1,513	\$1,558	\$1,605	\$1,653	\$1,702
7 Monitor of Vadose Zone (2 samples & lab testing @ \$17.5 each)	\$0.01	1	\$941	\$969	\$988	\$1,028	\$1,059	\$1,091	\$1,123	\$1,157	\$1,192
8 Closure											
9 Removal of operations layer/manure (2 ft layer @ \$3/ton CY)	\$0.22	563,494									
10 Test soil for microbes content (13 acres with 2 samples/test=26 samples and tests @ \$280 each))	\$0.02	1									
11 Test soil for microbes content (13 acres with 2 samples/test=26 samples and tests @ \$280 each))	\$0.00	563,494									
12 If concentrations represent a threat to groundwater, excavate 2 ft of below operations/manure layer. Assumed not necessary.											
13 Closure Costs											
14 Total Area: 4,383,953	2,817,474	\$86,428	\$89,021	\$91,691	\$94,442	\$97,275	\$100,194	\$103,199	\$106,295	\$109,484	\$112,769
C Milk Parlors											
Capital Costs											
1 GM (40-mils thick synthetic liner or at least 60-mils thick if the liner consists of HDPE) Cost reflects the material	\$0.75	9,087									
2 Concrete waterproof surface treatment (2 coats)	\$0.01	9,087									
3 COA testing of concrete during initialization (10% of capital costs)	\$0.18	1									
Operational Costs											
1 Annual Maintenance to fill cracks and inspection of concrete surface (Annual concrete slab costs of \$0.05 plus the capital costs divided by 40 years of operation)	\$0.10	9,087	\$1,202	\$1,238	\$1,275	\$1,313	\$1,353	\$1,393	\$1,435	\$1,478	\$1,522
Closure Costs											
1 Net closure costs											
2 Note: * In Size column refers to a lump sum or percentage that are one time costs.	Total Area:	27,263	\$1,202	\$1,238	\$1,275	\$1,313	\$1,353	\$1,393	\$1,435	\$1,478	\$1,522
3 Net Present Value :		\$2,940,000	\$89,914	\$92,612	\$95,390	\$98,252	\$101,199	\$104,235	\$107,362	\$110,583	\$113,901
Assumption: Inflation at: 3%											
Discount rate for NPV: 5%											

**Alternative 1 Net Present Value
Most Conservative Design Parameters**

Items	Year	Operations										Operations	Operations
		Cost/SF	Size** SF	Operations									
A Lagoon/Retention Ponds													
1 Primary liner consistent with Title 27 Class II Surface Impoundments GM (40-mils thick synthetic liner or at least 60-mile thick if the liner consists of HDPE)	\$0.50	192,401											
Leachate Collection and Removal System: Sumps and Pumps \$20,000 for 2 sumps & 2 pumps	\$0.50	192,401											
Capital Costs	\$0.10	1											
Leachate Collection and Removal System: Sumps and Pumps \$20,000 for 2 sumps & 2 pumps	\$0.10	1											
Second composite liner over GM/Compacted Clay Liner @ 1x10-9 cm/sec (at least 2 ft thick) or a GM/GCL @ 1x10-9 cm/sec	\$0.00	192,401											
2 Two foot minimum operations layer (local natural material) \$2/CY (geosynthetic cushion assumed no necessary)	\$0.15	192,401											
3 COA Procedures (10% of capital costs)	\$0.12	1											
4 Install Groundwater Monitoring Wells (2 wells @ \$3,947.50 each)	\$0.04	1											
5 Annual Maintenance													
Removal of solids/contaminant source (2 ft) (Assume no additional costs since it is already necessary as a part of normal operations and maintenance)	\$0.00	192,401											
6 Monitor of Groundwater wells (2 wells samples and testing @ \$8250 each)	\$0.01	1	\$1,860	\$1,916	\$1,974	\$2,033	\$2,094	\$2,157	\$2,221	\$2,288	\$2,357		
7 Monitor of Vadose Zone (2 samples & lab testing @ \$17.5 each)	\$0.01	1	\$264	\$1,302	\$1,332	\$1,423	\$1,466	\$1,510	\$1,555	\$1,602	\$1,650		
8 Closure													
Removal of liner (\$40CY)	\$0.30	192,401											
Closure Costs													
Subliner soil removal: evaluate major ions concentrations in soil and excavate (not necessary if geosynthetic lined or no evidence of leakage). Removal of 2 ft of soil below retention pond. (Assumed not necessary.)	\$0.00	192,401											
9 Closure Testing: Soil testing for triturations: 4.4 acres with 3 samples/test=10 samples and tests @ \$280 each)	\$0.01	1											
		1,539,216	\$3,070	\$3,163	\$3,257	\$3,355	\$3,456	\$3,559	\$3,666	\$3,776	\$3,889	\$4,006	
B Corrals													
1 Composite liner: low permeability barrier layer consistent with retention pond secondary composite system.	\$1.00	563,494											
GM/Compacted Clay Liner @ 1x10-9 cm/sec (at least 2 ft thick) or a GM/GCL @ 1x10-9 cm/sec	\$0.12	1											
2 COA Testing during installation of low permeability liner (10% of capital costs)	\$0.15	563,494											
3 Two foot minimum operations layer (local natural material) (geosynthetic cushion assumed no necessary)	\$0.02	1											
4 Install Groundwater Monitoring Wells (2 wells @ \$3,947.50 each)	\$0.11	563,494											
5 Remove manure source (two times a year @ \$3,947.50 CY (2 ft))	\$0.01	1	\$116,474	\$119,968	\$123,567	\$127,274	\$131,092	\$135,025	\$139,076	\$143,248	\$147,546		
6 Monitor of Groundwater wells (2 wells @ \$250 each)	\$0.01	1	\$1,860	\$1,916	\$1,974	\$2,033	\$2,094	\$2,157	\$2,221	\$2,288	\$2,357		
7 Monitor of Vadose Zone (2 samples & lab testing @ \$17.5 each)	\$0.01	1	\$264	\$1,302	\$1,332	\$1,423	\$1,466	\$1,510	\$1,555	\$1,602	\$1,650		
8 Closure													
Removal of operations layer/manure (2 ft layer @ \$3 per CY)	\$0.22	563,494											
Test soil for microbes content (13 acres with 2 samples/test=26 samples and tests @ \$280 each))	\$0.02	1											
(If concentrations represent a threat to groundwater, excavate 2 ft below operations/manure layer) Assumed not necessary.	\$0.00	563,494											
		2,817,474	\$116,152	\$119,636	\$123,225	\$126,922	\$130,30	\$134,682	\$138,691	\$142,882	\$147,138	\$151,562	
C Milk Parlors													
1 GM (40-mils thick synthetic liner or at least 60-mils thick if the liner consists of HDPE) Cost reflects the material	\$0.75	9,087											
Concrete waterproof surface treatment (2 coats)	\$0.01	9,087											
2 COA testing of concrete during initialization (10% of capital costs)	\$0.18	1											
3 Annual Maintenance to fill cracks and inspection of concrete surface (Annual concrete slab costs of \$0.05 plus the capital costs divided by 40 years of operation)	\$0.10	9,087	\$1,615	\$1,663	\$1,713	\$1,765	\$1,818	\$1,872	\$1,928	\$1,986	\$2,046	\$2,107	
Closure Costs													
4 No closure costs.													
** Note: * In Size column refers to a lump sum of percentage that are one time costs.	Total Area:	4,393,953	\$1,615	\$1,663	\$1,713	\$1,765	\$1,818	\$1,872	\$1,928	\$1,986	\$2,046	\$2,107	
	Net Present Value :		\$2,940,000										
Assumption: Inflation at: 3%													
Discount rate for NPV: 5%													

**Alternative 1 Net Present Value
Most Conservative Design Parameters**

Items	Year	31	32	33	34	35	36	37	38	39	40
	Cost/SF	Size** SF	Operations	Closure							
A Lagoon/Retention Ponds											
1 Primary liner consistent with Title 27 Class II Surface Impoundments GM (40-mils thick synthetic liner or at least 60-mil thick if the liner consists of HDPE)	\$0.50	192,401									
Leachate Collection and Removal System: Sumps and Pumps \$20,000 for 2 sumps & 2 pumps	\$0.50	192,401									
Capital Costs	\$0.10	1									
Leachate Collection and Removal System: Sumps and Pumps \$20,000 for 2 sumps & 2 pumps	\$0.10	1									
Second composite liner over GM/Compacted Clay Liner @ 1x10-9 cm/sec (at least 2 ft thick) or a GM/GCL @ 1x10-9 cm/sec	\$1.00	192,401									
2 Two foot minimum operations layer (local natural material) \$2/CY (geosynthetic cushion assumed no necessary)	\$0.15	192,401									
3 COA Procedures (10% of capital costs)	\$0.12	1									
4 Install Groundwater Monitoring Wells (2 wells @ \$3,947.50/each)	\$0.04	1									
5 Annual Maintenance											
Removal of solids/contaminant source (2 ft) (Assume no additional costs since it is already necessary as a part of normal operations and maintenance)	\$0.00	192,401									
6 Monitor of Groundwater wells (2 wells samples and testing @ \$8250 each)	\$0.01	1	\$2,427	\$2,500	\$2,575	\$2,652	\$2,732	\$2,814	\$2,898	\$2,985	\$3,075
7 Monitor of Vadose Zone (2 samples & lab testing @ \$17.5 each)	\$0.01	1	\$1,699	\$1,750	\$1,803	\$1,857	\$1,912	\$1,970	\$2,029	\$2,090	\$2,152
8 Closure											
Removal of liner (\$40/CY)	\$0.30	192,401									
Closure Costs	\$0.00	192,401									
Sublinear soil removal: evaluate major ions concentrations in soil and excavate (not necessary if geosynthetic lined or no evidence of leakage). Removal of 2 ft of soil below retention pond. (Assumed not necessary.)	\$0.00	1									
9 Closure Testing: Soil testing for tritium: 4.4 acres with 3 samples/acre=10 samples and tests @ \$280 each)	\$0.01	1	1,539,216	\$4,126	\$4,250	\$4,378	\$4,509	\$4,644	\$4,784	\$4,927	\$5,075
B Corrals											
Capital Costs	\$1.00	563,494									
1 Composite liner: low permeability barrier layer consistent with retention pond secondary composite system.	\$0.12	1									
GM/Compacted Clay Liner @ 1x10-9 cm/sec (at least 2 ft thick) or a GM/GCL @ 1x10-9 cm/sec	\$0.15	563,494									
2 COA Testing during installation of low permeability liner (10% of capital costs)	\$0.02	1									
3 Two foot minimum operations layer (local natural material) (geosynthetic cushion assumed no necessary)	\$0.11	563,494									
4 Install Groundwater Monitoring Wells (2 wells @ \$3,947.50/each)	\$0.01	1	\$15,927	\$15,931	\$16,1227	\$16,6054	\$17,046	\$17,5177	\$18,1462	\$18,8906	\$192,513
5 Remove manure source (two times a year @ \$3,947.50/each)	\$0.01	1	\$1,699	\$1,750	\$2,027	\$2,590	\$2,652	\$2,732	\$2,814	\$2,898	\$3,075
6 Monitor of Groundwater wells (2 wells @ \$250 each)	\$0.01	1	\$1,699	\$1,750	\$1,803	\$1,857	\$1,912	\$1,970	\$2,029	\$2,090	\$2,152
7 Monitor of Vadose Zone (2 samples & lab testing @ \$17.5 each)	\$0.01	1									
8 Closure											
Removal of operations layer/manure (2 ft layer @ \$3/ton CY)	\$0.22	563,494									
Test soil for microbes content (13 acres with 2 samples/acre=26 samples and tests @ \$280 each))	\$0.02	1									
(If concentrations represent a threat to groundwater, excavate 2 ft below operations/manure layer) Assumed not necessary.	\$0.00	563,494									
C Milk Parlors											
Capital Costs	2,817,474	\$156,088	\$160,781	\$165,605	\$170,573	\$175,90	\$180,981	\$186,389	\$191,981	\$197,741	\$232,223
1 GM (40-mils thick synthetic liner or at least 60-mils thick if the liner consists of HDPE) Cost reflects the material	\$0.75	9,087									
Concrete waterproof surface treatment (2 coats)	\$0.01	9,087									
2 COA testing of concrete during initialization (10% of capital costs)	\$0.18	1									
3 Annual Maintenance to fill cracks and inspection of concrete surface (Annual concrete slab costs of \$0.05 plus the capital costs divided by 40 years of operation)	\$0.10	9,087	\$2,170	\$2,236	\$2,303	\$2,372	\$2,443	\$2,516	\$2,592	\$2,669	\$2,749
Closure Costs	\$0.00	27,263	\$2,170	\$2,236	\$2,303	\$2,372	\$2,443	\$2,516	\$2,592	\$2,669	\$2,749
4 No closure costs.											
** Note: The Size column refers to a lump sum of percentage that are one time costs.	Total Area: 4,393,953	\$162,395	\$167,267	\$172,285	\$177,453	\$182,777	\$188,280	\$193,908	\$199,725	\$205,717	\$209,642
	Net Present Value :	\$2,940,000									
Assumption: Inflation at: 3%											
Discount rate for NPV: 5%											

Animal Waste Project
Table 2: Alternative 2
Intermediate Design Parameters

Items		Cost/SF
A Retention Ponds		
Capital Costs	1 Composite Liner	
	GM over GCL or Compacted Clay Layer (\$1/SF)	\$1.00
	2 Two foot minimum operations layer (local natural material) \$2/CY (geosynthetic cushion assumed not necessary)	\$0.15
	3 CQA Procedures (10% of capital costs)	\$0.12
Operational Costs	4 Install Groundwater Monitoring Wells (2 wells @ \$3,947.50 each)	\$0.04
	5 Annual Maintenance	
	Removal of solids/contaminant source (2 ft) (Assume no additional costs since it is already necessary as a part of normal operations and maintenance.)	\$0.00
	6 Monitor of Groundwater wells (2 wells @ \$250 each)	\$0.01
Closure Costs	7 Monitor of Vadose Zone (2 samples & lab testing @ \$175 each)	\$0.01
	8 Closure	
	Removal of Liner (\$4/CY)	\$0.30
	Subliner soil removal: evaluate major ions concentrations in soil and excavate (not necessary if geosynthetic lined or no evidence of leakage)). Removal of 2 ft of soil below retention pond-Assumed not necessary.	\$0.00
9 Closure Testing (Soil testing for major ions: 4.4 acres with 2-3 samples/acre=10 samples and tests @ \$280 each)		\$0.01
B Corrals		Cost/SF
Capital Costs	1 Liner: Geosynthetic clay liner or a minimum 1 ft compacted clay liner (with permeability of 1×10^{-7} or less)	\$1.00
	2 CQA Testing during installation of low permeability layer (10% of capital costs)	\$0.12
	3 Two foot minimum operations layer (local natural material) (geosynthetic cushion assumed not necessary)	\$0.15
	4 Install Groundwater Monitoring Wells (2 wells @ \$3,947.50 each)	\$0.02
Operational Costs	5 Remove manure (source) two times a year @\$3 per CY (2 ft)	\$0.11
	6 Monitor of Groundwater wells (2 wells @ \$250 each)	\$0.01
	7 Monitor of Vadose Zone (2 samples & lab testing @ \$175 each)	\$0.01
Closure Costs	8 Closure	
	Removal of operations layer/manure (2 ft layer @ \$3 per CY)	\$0.22
	Test soil for major ions content (13 acres with 2 samples/acre=26 samples and tests @ \$280 each)	\$0.02
	(If concentrations represent a threat to groundwater, excavate 2 ft of below operations/manure layer). Assumed not necessary.	\$0.00
C Milk Parlors		Cost/SF
Capital Costs	1 Concrete water-proof surface treatment (Silicone Dampproofing, sprayed (2 Coats))	\$1.01
	2 CQA testing of concrete during installation (10% of capital costs)	\$0.10
Operational Costs	Annual Maintenance to fill cracks and Inspection of concrete surface (Annual concrete slab cost of \$0.05 plus the capital costs divided by 40 years of operation)	\$0.08
Closure Costs	4 No closure costs.	\$0.00

**Alternative 2 Net Present Value
Intermediate Design Parameters**

Item	Description	Year									
		1	2	3	4	5	6	7	8	9	10
		Cost/SF	Size ^a /SF	Capital	Operations						
A Retention Ponds											
Capital Costs	1 Composite Liner: GCL over GCL or Compacted Clay Layer (\$1/SF) 2 Two foot minimum operations layer (local natural material \$2/CY (geosynthetic cushion assumed not necessary) 3 COA Procedures (10% of capital costs) 4 Install Groundwater Monitoring Wells (2 wells @ \$54.947.50 each)	\$1.00 \$0.15 \$0.12 \$0.04	192,401 192,401 1 1	\$192,401 \$20,860 \$22,916 \$7,900							
Operational Costs	5 Annual Maintenance Removal of soils/contaminant source (2 ft) (Assume no additional costs since it is already necessary as a part of normal operations and maintenance) 6 Monitor of Groundwater wells (2 wells @ \$54.947.50 each) 7 Monitor of Vadose Zone (2 samples & lab testing @ \$175 each) 8 Closure Removal of Liner (\$4/CY)	\$0.00 \$0.01 \$0.01 \$0.30	192,401 1 1 192,401	\$2,060 \$1,061 \$1,442 \$1,804	\$1,093 \$1,128 \$7,655 \$37,035	\$1,169 \$1,194 \$8,611 \$35,366	\$1,169 \$1,230 \$8,611 \$35,367	\$1,194 \$1,230 \$8,611 \$35,367	\$1,194 \$1,230 \$8,611 \$35,367	\$1,194 \$1,230 \$8,611 \$35,367	\$1,194 \$1,230 \$8,611 \$35,367
Closure Costs	Sublinear soil removal: evaluate major ions concentrations in soil and excavate (not necessary if geosynthetic lined or no evidence of sulfate). Removal of 2 ft of soil below retention pond-Assumed not necessary.	\$0.00	192,401								
	9 Closure Testing (Soil testing for major Ions: 4.4 acres with 2.3 samples/acre=10 samples and tests @ \$280 each)	\$0.01	1,154,412	\$252,076	\$3,502	\$1,804	\$1,858	\$1,913	\$1,971	\$2,030	\$2,154
											\$2,218
B Corral											
Capital Costs	1 Liner: Geosynthetic clay liner or a minimum 1 ft compacted clay liner with permeability of 1 x 10 ⁻⁷ on less 2 COA testing during installation of low permeability liner (10% of capital costs) 3 Two foot minimum operations layer (local natural material (geosynthetic cushion assumed not necessary) 4 Install Groundwater Monitoring Wells (2 wells @ \$54.947.50 each)	\$1.00 \$0.12 \$0.15 \$0.12	563,494 1 563,494 1	\$563,494 \$65,487 \$563,494 \$563,494							
Operational Costs	5 Remove manure (source) two times per year (@ \$54.947.50 each) 6 Monitor of Groundwater wells (2 wells @ \$54.947.50 each) 7 Monitor of Vadose Zone (2 samples & lab testing @ \$175 each) 8 Closure Removal of operations manure/ manure (2 ft layer @ \$3 per CY) Test soil for major ions content (3 acres with 2 samples/acre=26 samples and tests @ \$280 each) If concentrations represent a threat to groundwater, excavate 2 ft of below operations/manure layer). Assumed not necessary.	\$0.01 \$0.01 \$0.01 \$0.22 \$0.02 \$0.00	1 1 1 563,494 1 563,494	\$64,489 \$66,423 \$68,416 \$70,469 \$1,093 \$1,126 \$1,150 \$1,194 \$8,366 \$8,366 \$8,366 \$8,366	\$64,489 \$66,423 \$68,416 \$70,469 \$1,093 \$1,126 \$1,150 \$1,194 \$8,366 \$8,366 \$8,366 \$8,366	\$72,553 \$74,760 \$74,760 \$74,760 \$1,169 \$1,194 \$1,194 \$1,194 \$8,366 \$8,366 \$8,366 \$8,366	\$77,003 \$79,313 \$79,313 \$79,313 \$8,366 \$8,366 \$8,366 \$8,366 \$8,366 \$8,366 \$8,366 \$8,366	\$77,003 \$79,313 \$79,313 \$79,313 \$8,366 \$8,366 \$8,366 \$8,366 \$8,366 \$8,366 \$8,366 \$8,366	\$77,003 \$79,313 \$79,313 \$79,313 \$8,366 \$8,366 \$8,366 \$8,366 \$8,366 \$8,366 \$8,366 \$8,366	\$77,003 \$79,313 \$79,313 \$79,313 \$8,366 \$8,366 \$8,366 \$8,366 \$8,366 \$8,366 \$8,366 \$8,366	\$77,003 \$79,313 \$79,313 \$79,313 \$8,366 \$8,366 \$8,366 \$8,366 \$8,366 \$8,366 \$8,366 \$8,366
C Milk Parlor											
Capital Costs	1 Concrete waterproof surface treatment (Silicone Damp proofing sprayed (2 Coats)) 2 COA testing or concrete during installation (10% of capital costs) 3 Annual Maintenance to fill cracks and inspection of concrete surface (Annual concrete slab cost of \$0.05 plus the capital cost divided by 40 years of operation)	\$1.01 \$0.10 \$0.08	9,067 1 9,087	\$9,178 \$9,178 \$72,221	\$68,227 \$70,274	\$72,382 \$70,274	\$74,553 \$76,790				\$81,467
Operational Costs	4 No closure costs.	\$0.00	563,494								
Closure Costs	** Note: *1 in Size column refers to a lump sum or percentage that are one time costs.										
	Total Area:	27,263	\$10,096	\$728	\$750	\$772	\$785	\$819	\$844	\$869	\$895
	Net Present Value :	\$2,725,000	\$982,335	\$72,221	\$70,780	\$72,904	\$75,991	\$77,344	\$79,664	\$82,054	\$84,515
	Assumption: Inflation at : 3% Discount rate for NPV: 5%										\$8,7051

**Alternative 2 Net Present Value
Intermediate Design Parameters**

Item	Cost/TSF	Size ^a SF	Year			Operations			Operations			Operations			
			11	12	13	14	15	16	17	18	19	20	11	12	13
A Retention Ponds															
Capital Costs	\$1.00	192,401													
1 Composite Liner: GCL over GCL or Compacted Clay Layer (\$1/SF)	\$0.15	192,401													
2 Two foot minimum operations layer (local natural material) \$2/CY (geosynthetic cushion assumed not necessary)	\$0.12	1													
3 COA Procedures (10% of capital costs)	\$0.04	1													
4 Install Groundwater Monitoring Wells (2 wells @ \$54.947.50 each)															
Operational Costs															
5 Annual Maintenance:															
Removal of soils/contaminant source (2 ft) (Assume no additional costs since it is already necessary as a part of removal activities and maintenance)	\$0.00	192,401													
6 Monitor of Groundwater wells (2 wells @ \$54.947.50 each)	\$0.01	1	\$1,344	\$1,384	\$1,426	\$1,469	\$1,513	\$1,558	\$1,605	\$1,653	\$1,702	\$1,754			
7 Monitor of Vadose Zone (2 samples & lab testing @ \$175 each)	\$0.01	1	\$341	\$969	\$996	\$1,028	\$1,059	\$1,091	\$1,123	\$1,157	\$1,192	\$1,227			
8 Closure:															
Removal of Liner (\$4/CY)	\$0.30	192,401													
Closure Costs															
Subliner soil removal: evaluate major ions concentrations in soil and excavate (not necessary if geosynthetic lined or no evidence of sulfate). Removal of 2 ft of soil below retention pond-Assumed not necessary.	\$0.00	192,401													
9 Closure Testing (Soil testing for major Ions: 4.4 acres with 2.3 samples/acre=10 samples and tests @ \$280 each)	\$0.01	1	1,154,412	\$2,265	\$2,353	\$2,424	\$2,497	\$2,571	\$2,649	\$2,723	\$2,794	\$2,864			
B Corral															
Capital Costs	\$1.00	563,494													
1 Liner: Geosynthetic clay liner or a minimum 1 ft compacted clay liner with permeability of 1 x 10 ⁻⁷ on less	\$0.12	1													
2 COA testing during installation of low permeability liner (10% of capital costs)	\$0.15	563,494													
3 Two foot minimum operations layer (local natural material (geosynthetic cushion assumed not necessary))	\$0.12	1,148													
4 Install Groundwater Monitoring Wells (2 wells @ \$54.947.50 each)	\$0.11	563,494	\$841,13	\$86,667	\$89,267	\$91,946	\$94,704	\$97,545	\$100,471	\$103,485	\$106,590	\$109,788			
Operational Costs															
5 Remove manure (source) two times per year (@ \$54 per CY (2 ft))	\$0.01	1	\$1,344	\$1,384	\$1,426	\$1,469	\$1,513	\$1,558	\$1,605	\$1,653	\$1,702	\$1,754			
6 Monitor of Groundwater wells (2 wells @ \$250 each)	\$0.01	1	\$341	\$969	\$996	\$1,028	\$1,059	\$1,091	\$1,123	\$1,157	\$1,192	\$1,227			
7 Monitor of Vadose Zone (2 samples & lab testing @ \$175 each)															
8 Closure:															
Removal of operations manure/milk (2 ft layer @ \$3 per CY)	\$0.22	563,494													
9 Test soil for major ions content (13 acres with 2 samples/acre=26 samples and tests @ \$280 each)	\$0.02	1													
Closure Costs															
If concentrations represent a threat to groundwater, excavate 2 ft of below operations/manure layer). Assumed not necessary.	\$0.00	563,494													
C Milk Parlor															
Capital Costs	\$1.01	9,037													
1 Concrete waterproof surface treatment (Silicone Damp proofing sprayed (2 Coats))	\$0.10	1													
2 COA testing of concrete during installation (10% of capital costs)	\$0.08	9,038	\$950	\$978	\$1,008	\$1,038	\$1,069	\$1,101	\$1,134	\$1,168	\$1,203	\$1,239			
Operational Costs															
3 Annual Maintenance to fill cracks and inspection of concrete surface (Annual concrete slab cost of \$0.05 plus the cost of concrete)	\$0.00														
4 No closure costs.															
Total Area:	3,998,149	27,263	\$950	\$978	\$1,008	\$1,038	\$1,069	\$1,101	\$1,134	\$1,168	\$1,203	\$1,239			
Net Present Value :	\$2,725,000		\$85,662	\$92,352	\$95,123	\$97,976	\$100,916	\$103,943	\$107,062	\$110,273	\$113,582	\$116,899			

Assumption: Inflation at : 3%
Discount rate for NPV: 5%

**Alternative 2 Net Present Value
Intermediate Design Parameters**

Item	Cost (\$/SF)	Size** SF	Year			Operations			Operations			Operations			
			21	22	23	24	25	26	27	28	29	30	31	32	33
A Retention Ponds															
Capital Costs	\$1.00	192,401													
1 Composite Liner: GCL over GCL or Compacted Clay Layer (\$1/SF)	\$0.15	192,401													
2 Two foot minimum operations layer (local natural material) \$2/CY (geosynthetic cushion assumed not necessary)	\$0.12	1													
3 COA Procedures (10% of capital costs)	\$0.04	1													
4 Install Groundwater Monitoring Wells (2 wells @ \$54,947.50 each)															
Operational Costs															
5 Annual Maintenance:															
Removal of soils/contaminant source (2 ft) (Assume no additional costs since it is already necessary as a part of removal activities and maintenance)	\$0.00	192,401													
6 Monitor of Groundwater wells (2 wells @ \$54,947.50 each)	\$0.01	1	\$1,860	\$1,660	\$1,916	\$1,074	\$0,933	\$2,064	\$2,157	\$2,231	\$2,286	\$2,357			
7 Monitor of Vadose Zone (2 samples & lab testing @ \$175 each)	\$0.01	1	\$1,264	\$1,302	\$1,341	\$1,382	\$1,423	\$1,466	\$1,510	\$1,555	\$1,602	\$1,650			
8 Closure:															
Removal of Liner (\$4/CY)	\$0.30	192,401													
Closure Costs															
Subliner soil removal: evaluate major ions concentrations in soil and excavate (not necessary if geosynthetic lined or no evidence of sulfate). Removal of 2 ft of soil below retention pond-Assumed not necessary.	\$0.00	192,401													
9 Closure Testing (Soil testing for major Ions: 4.4 acres with 2.3 samples/acre=10 samples and tests @ \$280 each)	\$0.01	1	1,154,412	\$3,070	\$3,163	\$3,257	\$3,355	\$3,456	\$3,559	\$3,666	\$3,776	\$3,889	\$4,006		
B Corral															
Capital Costs	\$1.00	563,494													
1 Liner: Geosynthetic clay liner or a minimum 1 ft compacted clay liner: with permeability of 1x -10 -1 less	\$0.12	1													
2 COA testing during installation of low permeability liner (10% of capital costs)	\$0.15	563,494													
3 Two foot minimum operations layer (local natural material (geosynthetic cushion assumed not necessary))	\$0.12	563,494													
4 Install Groundwater Monitoring Wells (2 wells @ \$54,947.50 each)	\$0.11	563,494	\$113,081	\$16,474	\$119,566	\$123,567	\$127,274	\$131,692	\$135,095	\$139,076	\$143,248	\$147,546			
Operational Costs															
5 Remove manure source (two times a year @ \$54,947.50 per CY (2 ft))	\$0.01	1	\$1,806	\$1,660	\$1,916	\$1,074	\$0,933	\$2,064	\$2,157	\$2,231	\$2,286	\$2,357			
6 Monitor of Groundwater wells (2 wells @ \$250 each)	\$0.01	1	\$1,264	\$1,302	\$1,341	\$1,382	\$1,423	\$1,466	\$1,510	\$1,555	\$1,602	\$1,650			
7 Monitor of Vadose Zone (2 samples & lab testing @ \$175 each)															
8 Closure:															
Removal of operations manure/marsh (2 ft layer @ \$3 per CY)	\$0.22	563,494													
9 Test soil for major ions content (3 acres with 2 samples/acre=26 samples and tests @ \$280 each)	\$0.02	1													
Closure Costs															
If concentrations represent a threat to groundwater, excavate 2 ft of below operations/manure layer). Assumed not necessary.	\$0.00	563,494													
C Milk Parlor															
Capital Costs	\$1.01	9,037													
1 Concrete waterproof surface treatment (Silicone Damp proofing sprayed (2 Coats))	\$0.10	1													
2 COA testing or concrete during installation (10% of capital costs)	\$0.08	9,087	\$1,277	\$1,316	\$1,394	\$1,437	\$1,480	\$1,524	\$1,570	\$1,617	\$1,666				
Operational Costs															
3 Annual Maintenance to fill cracks and inspection of concrete surface (Annual concrete slab cost of \$0.05 plus the cost of 4 closure costs)	\$0.00														
Closure Costs															
4 No closure costs.															
** Note: *1 in Size column refers to a lump sum or percentage that are one time costs.															
Total Area:	3,998,149		\$1,277	\$1,316	\$1,354	\$1,395	\$1,437	\$1,480	\$1,524	\$1,570	\$1,617	\$1,666			
Net Present Value :	\$2,725,000		\$120,499	\$124,114	\$127,337	\$131,672	\$135,622	\$139,991	\$143,862	\$148,198	\$152,644	\$157,223			

Assumption: Inflation at : 3%
Discount rate for NPV: 5%

**Alternative 2 Net Present Value
Intermediate Design Parameters**

Item	Cost/TSF	Size ^a SF	Year			Operations	Operations	Operations	Operations	Operations	Operations	Closure
			31	32	33							
A Retention Ponds												
Capital Costs	\$1.00	192,401										
1 Composite Liner: GCL over GCL or Compacted Clay Layer (\$1/SF)	\$0.15	192,401										
2 Two foot minimum operations layer (local natural material \$2/CY (geosynthetic cushion assumed not necessary))	\$0.12	1										
3 COA Procedures (10% of capital costs)	\$0.04	1										
4 Install Groundwater Monitoring Wells (2 wells @ \$54.947.50 each)												
Operational Costs												
5 Annual Maintenance: Removal of soils/contaminant source (2 ft) (Assume no additional costs since it is already necessary as a part of item specifications and maintenance)	\$0.00	192,401										
6 Monitor of Groundwater wells (2 wells @ \$54.950 each)	\$0.01	1	\$2,427	\$2,500	\$2,575	\$2,652	\$2,732	\$2,814	\$2,898	\$2,985	\$3,075	
7 Monitor of Vadose Zone (2 samples & lab testing @ \$175 each)	\$0.01	1	\$1,659	\$1,750	\$1,803	\$1,857	\$1,912	\$1,970	\$2,029	\$2,080	\$2,152	
8 Closure: Removal of Liner (\$4/CY)	\$0.30	192,401										
Closure Costs												
Subliner soil removal: evaluate major ions concentrations in soil and excavate (not necessary if geosynthetic lined or no evidence of sulfate). Removal of 2 ft of soil below retention pond-Assumed not necessary.	\$0.00	192,401										
9 Closure Testing (Soil testing for major Ions: 4.4 acres with 2.3 samples/acre=10 samples and tests @ \$280 each)	\$0.01	1	\$1,154,412	\$4,126	\$4,250	\$4,378	\$4,509	\$4,644	\$4,784	\$4,927	\$5,075	\$5,227
B Corral												
Capital Costs	\$1.00	563,494										
1 Liner: Geosynthetic clay liner or a minimum 1 ft compacted clay liner with permeability of 1x -10 -1 less	\$0.12	1										
2 COA testing during installation of low permeability layer (10% of capital costs)	\$0.15	563,494										
3 Two foot minimum operations layer (local natural material (geosynthetic cushion assumed not necessary))	\$0.12	193,494										
4 Install Groundwater Monitoring Wells (2 wells @ \$54.947.50 each)	\$0.11	563,494	\$151,972	\$156,531	\$161,227	\$166,064	\$171,046	\$176,777	\$181,482	\$186,806	\$192,513	
Operational Costs												
5 Remove manure source (two times a year @ \$54 per CY (2 ft))	\$0.01	1	\$2,427	\$2,500	\$2,575	\$2,652	\$2,732	\$2,814	\$2,898	\$2,985	\$3,075	
6 Monitor of Groundwater wells (2 wells @ \$250 each)	\$0.01	1	\$1,659	\$1,750	\$1,803	\$1,857	\$1,912	\$1,970	\$2,029	\$2,080	\$2,152	
7 Monitor of Vadose Zone (2 samples & lab testing @ \$175 each)												
8 Closure: Removal of operations manure/marsh (2 ft layer @ \$3 per CY)	\$0.22	563,494										
Closure Costs												
9 Test soil for major ions content (3 acres with 2 samples/acre=26 samples and tests @ \$280 each) (If concentrations represent a threat to groundwater, excavate 2 ft of below operations/manure layer). Assumed not necessary.	\$0.00	563,494	\$165,095	\$160,781	\$170,573	\$175,690	\$180,861	\$186,389	\$191,981	\$197,741	\$202,223	\$207,420
C Milk Parlor												
Capital Costs	\$1.01	9,037										
1 Concrete waterproof surface treatment (Silicone Damp proofing sprayed (2 Coats))												
2 COA testing or concrete during installation (10% of capital costs)	\$0.10	1										
Operational Costs												
3 Annual Maintenance to fill cracks and inspection of concrete surface (Annual concrete slab cost of \$0.05 plus the capital cost divided by 40 years of operation)	\$0.08	9,087	\$1,716	\$1,767	\$1,820	\$1,875	\$1,931	\$1,989	\$2,048	\$2,110	\$2,173	
Closure Costs												
4 No closure costs.	\$0.00											
Total Area:	3,998,149		\$1,716	\$1,767	\$1,820	\$1,875	\$1,931	\$1,989	\$2,048	\$2,110	\$2,173	\$0
Net Present Value :	\$2,725,000		\$161,940	\$166,798	\$171,802	\$176,956	\$182,265	\$187,733	\$193,355	\$199,166	\$205,141	\$209,642

Assumption: Inflation at : 3%
Discount rate for NPV: 5%

Animal Waste Project
Table 3: Alternative 3
Least Conservative Design Parameters

Items		Cost/SF
A Lagoon/Retention Ponds		
Capital Costs	1 Liner consistent with NRCS guidelines (maximum seepage rate of 1×10^{-6} cm/sec with no credit for manure sealing.)	
	1 ft compacted clay @ 1×10^{-6} cm/sec or less	\$0.55
	2 Two foot minimum operations layer (local natural material) \$2/CY (geosynthetic cushion assumed not necessary)	\$0.15
	3 CQA Procedures (10% of capital costs)	\$0.07
Operational Costs	4 Install Groundwater Monitoring Wells (2 wells @\$3,947.50 each)	\$0.04
	5 Annual Maintenance	
	Removal of solids/contaminant source (2 ft) (Assume no additional costs since it is already necessary as a part of normal operations and maintenance.)	\$0.00
	6 Monitor of Groundwater wells (2 wells @\$250 each)	\$0.01
Closure Costs	7 Monitor of Vadose Zone (2 samples & lab testing @ \$175 each)	\$0.01
	8 Closure	
	Removal of Liner (\$4/CY)	\$0.30
	Assume removal of 2 ft of soil below retention pond. Assume \$3 to excavate and \$3 to treat contaminated soil per CY	\$0.44
9 Closure Testing (Soil testing for major ions: 4.4 acres with 2-3 samples/acre=10 samples and tests @ \$280 each)		\$0.01
B Corrals		Cost/SF
Capital Costs	1 Liner consistent with Kings County Ordinance (naturally occurring clay (not less than 20 percent clay and silt)). *	\$0.50
	2 CQA Testing during installation of low permeability layer (10% of capital costs)	\$0.07
	3 Two foot minimum operations layer (local natural material) (geosynthetic cushion assumed not necessary)	\$0.15
	4 Install Groundwater Monitoring Wells (2 wells @\$3,947.50 each)	\$0.02
Operational Costs	5 Remove manure (source) two times a year @\$3 per CY (2 ft)	\$0.11
	6 Monitor of Groundwater wells (2 wells @\$250 each)	\$0.01
	7 Monitor of Vadose Zone (2 samples & lab testing @ \$175 each)	\$0.01
Closure Costs	8 Closure	
	Removal of operations layer/manure (2 ft layer @ \$3 per CY)	\$0.22
	Test soil for major ions content (13 acres with 2 samples/acre=26 samples and tests @ \$280 each)	\$0.02
	(If concentrations represent a threat to groundwater, excavate 2 ft of below operations/manure layer). Assume removal is necessary. Assume \$3 to excavate and \$3 to treat contaminated soil per CY	\$0.44
*Kings County ordinance criteria used since it was based off of NRCS Guidelines		
C Milk Parlors**		Cost/SF
Capital Costs	1 Concrete per CCR Title 3	\$0.00
	2 CQA testing of concrete during installation (10% of capital costs)	\$0.00
Operational Costs	Annual Maintenance to fill cracks and Inspection of concrete surface (Annual concrete slab cost of \$0.05 plus the capital costs divided by 40 years of operation)	\$0.05
Closure Costs	3 No closure necessary.	\$0.00

**Assume current regulations/no new costs

**Alternative 3 Net Present Value
Least Conservative Design Parameters**

Items	Year									
	1	2	3	4	5	6	7	8	9	10
A Lagoon/Retention Ponds										
Capital Costs	1 Liner consistent with NRCS guidelines (maximum seepage rate of 1x10-6 cm/sec with no credit for manure sealing.) 2 Two foot compaction clay @ 106 cu/sec or less. 3 CCA Procedures (10% of Capital Costs) 4 Initial Groundwater Monitoring Wells (2 wells @ \$3,947.50 each) 5 Annual Maintenance 6 Removal of oil/solvent contaminant source (2 ft) (Assume no additional costs since it is already necessary as a part of normal operations and maintenance.) 7 Monitor of Vadose Zone wells (2 wells @ \$250 each) 8 Closure 9 Closure Testing (Soil testing for major ions, 4.4 acres with 2.3 samples/acre= 10 samples and tests @ \$280 each)	\$0.55 \$0.15 \$0.07 \$0.04 \$0.04 \$0.00 \$0.01 \$0.01 \$0.01	192,401 192,401 1 1 192,401 1 1 192,401 1,412	\$105,821 \$28,860 \$14,268 \$7,900 \$1,053 \$2,060 \$1,061 \$765 \$1,858 \$3,502 \$1,804 \$1,858 \$1,913 \$1,977 \$2,030 \$2,091	Operations Operations Operations Operations Operations Operations Operations Operations Operations Operations Operations Operations Operations Operations Operations Operations Operations					
Operational Costs										
Closure Costs	Excavate soil if major ions concentrations are found through testing (not necessary if no evidence of leakage). Assume removal of 2 ft of soil below retention pond. Assume \$3 to excavate and \$3 to treat contaminated soil per CY	\$0.44	192,401							
B Corrales										
Capital Costs	1 Liner consistent with Kings County Ordinance (naturally occurring clay (not less than 20 percent clay and silt). * 2 CCA Testing during installation of low permeability layer (10% of capital costs) 3 Two foot minimum operations layer (local natural material (geosynthetic cushion assumed not necessary) 4 Initial Groundwater Monitoring Wells (2 wells @ \$3,347.50 each) 5 Remove manure (source) two times a year (\$3 per CY / ft) 6 Monitor of Groundwater wells (2 wells @ \$250 each) 7 Monitor of Vadose Zone (2 samples & lab testing @ \$175 each) 8 Closure 9 Removal of operations layer/manure (2 ft layer @ \$3 per CY) 10 Soil for major ions content (13 acres with 1 samples/acre=20 samples and tests @ \$280 each). Assume removal is necessary. Assume \$3 to excavate and \$3 to treat contaminated soil per CY	\$0.50 \$0.07 \$0.15 \$0.02 \$0.11 \$0.01 \$0.01 \$0.22 \$0.02 \$0.44	563,494 1 563,494 1 563,494 1 563,494 1 563,494 1 563,494	\$28,747 \$37,313 \$83,481 \$7,900 \$64,489 \$2,060 \$1,061 \$765 \$1,858 \$3,502 \$1,804 \$1,858 \$1,913 \$1,977 \$2,030 \$2,091	Operations Operations Operations Operations Operations Operations Operations Operations Operations Operations Operations Operations Operations Operations Operations Operations Operations Operations					
Operational Costs										
Closure Costs										
C Milk Parlors**										
Capital Costs	1 Concrete per CCR Title 3 2 CCA testing of concrete during installation (10% of capital costs) 3 Annual Maintenance to fill cracks and inspection of concrete surfaces (Annual concrete slab cost of \$0.05 plus the capital costs divided by 40 years of operation)	\$0.00 \$0.00 \$0.05	0 1 0.087	\$0 \$0 \$0.087						
Operational Costs										
Closure Costs	4 No closure necessary ** Assume current regulations/no new costs ** Note: * in Size column refers to a lump sum or percentage that are one time costs.	\$0.00		\$468 \$462 \$497	\$468 \$462 \$497	\$511 \$527	\$527	\$543	\$559	\$576
Total Area:	18,176	\$68,227 \$70,274 \$72,382	\$74,553	\$76,790	\$79,094	\$81,467	\$83,911	\$86,428		
Net Present Value :	\$2,479,000	\$567,279	\$71,961	\$70,512	\$74,807	\$77,051	\$79,362	\$81,743	\$84,196	\$86,721
Assumption: Inflation at:	3%									
Discount rate for NPV:	5%									

* Note: * in Size column refers to a lump sum or percentage that are one time costs.

** Assume current regulations/no new costs

** Note: * in Size column refers to a lump sum or percentage that are one time costs.

**Alternative 3 Net Present Value
Least Conservative Design Parameters**

Item	Lagoon/Retention Ponds	Year										Operations	Operations	Operations	Operations	Operations	
		12	13	14	15	16	17	18	19	20	21						
A Lagoon/Retention Ponds																	
Capital Costs	1 Liner consistent with NRCS guidelines (maximum seepage rate of 1x10-6 cm/sec with no credit for manure sealing.) 2 Two foot minimum liner (local natural material \$2/CY (geosynthetic cushion assumed not necessary)) 3 COA Procedures (10% of Capital Costs) 4 Initial Groundwater Monitoring Wells (2 wells @ \$3,947.50 each) 5 Annual Maintenance 6 Monitor of Groundwater wells (2 wells @ \$250/each) 7 Monitor of Vadose Zone (2 samples & lab testing @ \$175 each) 8 Closure 9 Closure Testing (Soil testing for major lans. 4.4 acres with 2.3 samples/acre= 10 samples and tests @ \$280 each)	\$0.55	192,401														
Operational Costs	1 Removal of ions/contaminant source (2 ft) (Assume no additional costs since it is already necessary as a part of normal operations and maintenance.) 2 Removal of liner (\$4/CY) 3 Assume removal of 2 ft of soil below retention pond. Assume \$3 to excavate and \$3 to treat contaminated soil per CY 4 Excavate soil if major ions concentrations are found through testing (not necessary if no evidence of leakage). Assume removal is 2 ft of soil below retention pond. Assume \$3 to excavate and \$3 to treat contaminated soil per CY 5 Closure Testing (Soil testing for major lans. 4.4 acres with 2.3 samples/acre= 10 samples and tests @ \$280 each)	\$0.00	192,401														
Closure Costs	1	1,154,412	\$2,353	\$2,424	\$2,497	\$2,571	\$2,649	\$2,728	\$2,810	\$2,894	\$2,981	\$3,070	\$3,163	\$3,257			
B Corrals																	
Capital Costs	1 Liner consistent with Kings County Ordinance (naturally occurring clay (not less than 20 percent clay and silt). * 2 COA Testing during installation of low permeability layer (10% of capital costs) 3 Two foot minimum operations liner (local natural material (geosynthetic cushion assumed not necessary)) 4 Initial Groundwater Monitoring Wells (2 wells @ \$3,347.50 each) 5 Remove manure (source) two times a year (\$3 per CY / ft) 6 Monitor of Groundwater wells (2 wells @ \$250/each) 7 Monitor of Vadose Zone (2 samples & lab testing @ \$175 each) 8 Closure 9 Removal of operations layer/manure (2 ft layer @ \$3 per CY) 10 Soil for major lans. content (13 acres with 1 samples/acre=26 samples and tests @ \$280 each) 11 Closure Testing (Soil testing for major lans. 4.4 acres with 2.3 samples/acre= 10 samples and tests @ \$280 each). Assume removal is necessary. Assume \$3 to excavate and \$3 to treat contaminated soil per CY	\$0.50	563,494														
Operational Costs	1	2,817,474	\$89,021	\$91,691	\$94,442	\$97,275	\$100,194	\$103,199	\$106,295	\$109,484	\$112,669	\$116,152	\$119,636	\$123,225			
C Milk Parlors**																	
Capital Costs	1 Concrete per CCR Title 3 2 COA testing of concrete during installation (10% of capital costs) 3 Annual Maintenance to fill cracks and inspection of concrete surface (Annual concrete slab cost of \$0.05 plus the capital costs divided by 40 years of operation)	\$0.00	9,087														
Closure Costs	4 No closure necessary	\$0.05	9,087	\$629	\$648	\$667	\$687	\$708	\$729	\$751	\$774	\$797	\$821	\$845	\$871		
Total Area:		18,176	\$629	\$648	\$667	\$687	\$708	\$729	\$751	\$774	\$797	\$821	\$845	\$871			
Net Present Value :		\$92,003	\$94,763	\$97,606	\$100,534	\$103,550	\$106,656	\$109,856	\$113,152	\$116,546	\$120,043	\$123,644	\$127,383				

* Note: "1" in Size column refers to a lump sum or percentage that are one time costs.

** Assume current regulations/no new costs

** Note: "1" in Size column refers to a lump sum or percentage that are one time costs.

Assumption: Inflation at:
3%
Discount rate for NPV:
5%

**Alternative 3 Net Present Value
Least Conservative Design Parameters**

Items	Year									
	24	25	26	27	28	29	30	31	32	33
	Cost/SF	Size** SF	Operations							
A Lagoon/Retention Ponds										
1 Liner consistent with NRCS guidelines (maximum seepage rate of 1x10-6 cm/sec with no credit for manure sealing.)	\$0.55	192,401								
2 Two foot minimum operations layer (local natural material \$2/CY) (geosynthetic cushion assumed not necessary)	\$0.15	192,401								
3 COA Procedure & 10% Capital Costs	\$0.07	1								
4 Initial Groundwater Monitoring Wells (2 wells @ \$3,947.50 each)	\$0.04	1								
5 Annual Maintenance										
Removal of ions contaminant source (2 ft) (Assume no additional costs since it is already necessary as a part of normal operations and maintenance.)	\$0.00	192,401								
6 Monitor of Groundwater wells (2 wells @ \$250 each)	\$0.01	1	\$1,974	\$2,033	\$2,094	\$2,157	\$2,221	\$2,288	\$2,357	\$2,427
7 Monitor of Vadose Zone (2 samples & lab testing @ \$175 each)	\$0.01	1	\$1,382	\$1,423	\$1,466	\$1,510	\$1,555	\$1,602	\$1,650	\$1,699
8 Closure										
Removal of liner (\$4/CY)	\$0.30	192,401								
9 Closure Testing (Soil testing for major ions, 4.4 acres with 2.3 samples/acre= 10 samples and tests @ \$280 each)	\$0.44	192,401								
Closure Costs										
Excavate soil if major ions concentrations are found through testing (not necessary if no evidence of leakage), Assume removal of 2 ft of soil below retention pond. Assume \$3 to excavate and \$3 to treat contaminated soil per CY	\$0.44	192,401								
9 Closure Testing (Soil testing for major ions, 4.4 acres with 2.3 samples/acre= 10 samples and tests @ \$280 each)	\$0.01	1,154,412	\$3,355	\$3,456	\$3,559	\$3,666	\$3,776	\$3,889	\$4,006	\$4,126
B Corals										
1 Liner consistent with Kings County Ordinance (naturally occurring clay (not less than 20 percent clay and silt). *	\$0.50	563,494								
2 COA Testing during installation of low permeability layer (10% of capital costs)	\$0.07	1								
3 Two foot minimum operations layer (local natural material (geosynthetic cushion assumed not necessary)	\$0.15	563,494								
4 Initial Groundwater Monitoring Wells (2 wells @ \$3,947.50 each)	\$0.02	1								
5 Remove mature (source) two times a year (\$3 per CY / ft)	\$0.11	563,494								
6 Monitor of Groundwater wells (2 wells @ \$250 each)	\$0.01	1	\$1,974	\$2,033	\$2,094	\$2,157	\$2,221	\$2,288	\$2,357	\$2,427
7 Monitor of vadose Zone (2 samples & lab testing @ \$175 each)	\$0.01	1	\$1,382	\$1,423	\$1,466	\$1,510	\$1,555	\$1,602	\$1,650	\$1,699
8 Closure										
Removal of operations layer/manure (2 ft layer @ \$3 per CY)	\$0.22	563,494								
9 Closure Costs										
Test soil for major ions content (13 acres with 1 samples/acre=26 samples and tests @ \$280 each) Assume removal is necessary. Assume \$3 to excavate and \$3 to treat contaminated soil per CY	\$0.44	563,494								
C Milk Parlors**										
Capital	1 Concrete per CCR Title 3									
Operational Costs	2 COA testing of concrete during installation (10% of capital costs)	\$0.00	9,087							
Closure Costs	3 Annual Maintenance to fill cracks and inspection of concrete surface (Annual concrete slab cost of \$0.05 plus the capital costs divided by 40 years of operation)	\$0.05	9,087	\$897	\$924	\$951	\$980	\$1,009	\$1,040	\$1,071
Closure Costs	4 No closure necessary	\$0.00								
Total Area:	18,776	\$997	\$924	\$951	\$980	\$1,009	\$1,040	\$1,071	\$1,103	\$1,136
Net Present Value :	\$2,479,000	\$131,174	\$135,109	\$139,163	\$143,337	\$147,638	\$152,067	\$156,629	\$161,327	\$166,167
Assumption: Inflation at:										
3%										
Discount rate for NPV:										
5%										

* Note: * in Size column refers to a lump sum or percentage that are one time costs.

** Assume current regulations/no new costs
Total Area: 3,990,062
Net Present Value : \$2,479,000
Assumption: Inflation at 3%
Discount rate for NPV: 5%

Alternative 3 Net Present Value
Least Conservative Design Parameters

Items		Cost/SF	Size** SF	Operations	Operations	Operations	Closure
A Lagoon/Retention Ponds							
Capital Costs	1 Liner consistent with IRRCS guidelines (maximum seepage rate of 1 x 10-6 cm/sec with no credit for manure sealing.) 2 Two foot minimum operations layer (local natural material) \$2/CY (geosynthetic cushion assumed not necessary) 3 COA Procedures (10% of capital costs)	\$0.55 \$0.15 \$0.07	192,401 192,401 1				
Operational Costs	4 Initial Groundwater Monitoring Wells (2 wells @ \$3,947.50 each) 5 Annual Maintenance Renoval of solids/contaminant source (Assume no additional costs since it is already necessary as a part of normal operations and maintenance.) 6 Monitor of Groundwater wells (2 wells @ \$250 each) 7 Monitor of Vadose Zone (2 samples & lab testing @ \$175 each) 8 Closure Removal of Litter (\$4/CY) Excavable soil (Major ions concentrations are found through testing (not necessary if no evidence of leakage). Assume removal of 2 ft of soil below retention pond. Assume \$3 to excavate and \$3 to treat contaminated soil per CY)	\$0.04 \$0.00 \$0.01 \$0.01 \$0.30 \$0.44	1 192,401 1 \$2,614 \$1,1570 192,401 192,401				
Closure Costs	9 Closure Testing (Soil testing for major ions: 4.4 acres with 2-3 samples/acre=10 samples and tests @ \$280 each)	\$0.01	1,154,412	\$4,784	\$4,927	\$5,075	\$9,134 \$47,412,362
B Contests							
Capital Costs	1 Line consistent with Kings County Ordinance (naturally occurring clay (not less than 20 percent clay and silt). 2 COA testing during installation of low permeability layer (10% of capital costs) 3 Two foot minimum operations layer (local natural material) (geosynthetic cushion assumed not necessary) 4 Initial Groundwater Monitoring Wells (2 wells @ \$3,947.50 each)	\$0.50 \$0.07 \$0.15 \$0.02	563,494 1 563,494 1				
Operational Costs	5 Remove manure (source two times a year @ \$3 per CY (2 ft) 6 Monitor of Groundwater wells (2 wells @ \$250 each) 7 Monitor of Vadose Zone (2 samples & lab testing @ \$175 each) 8 Closure Renoval of operations layer (2 ft) (2 wells @ \$3 per CY) Test for major ions contaminant (1.3 acres with 2 samples/test=26 samples and tests @ \$280 each) If concentrations represent a threat to groundwater, excavate 2 ft of below operations (manure layer). Assume removal is necessary. Assume \$3 to excavate and \$3 to treat contaminated soil per CY	\$0.11 \$0.01 \$0.01 \$0.22 \$0.02 \$0.44	\$176,177 \$2,614 \$1,1570 \$2,688 \$2,029 563,494 \$180,961	\$181,462 \$2,688 \$1,1570 \$2,688 \$2,029 563,494 \$181,961	\$192,515.3 \$2,085 \$2,152 \$2,090 \$2,090 \$191,961	\$192,515.3 \$2,085 \$2,152 \$2,090 \$2,090 \$191,961 \$197,744 \$197,744	
C Milk Parlors**							
Capital Costs	1 Concrete per CCR Title 3 2 COA testing of concrete during installation (10% of capital costs) 3 Annual Maintenance to repair cracks and inspection of concrete surface (Annual concrete slab cost of \$0.05 plus the capital costs divided by 40 years of operation)	\$0.00 \$0.00 \$0.05	9,087 1 9,087				
Closure Costs	4 No closure necessary. ** Assume current regulations/no new costs	\$0.00					
Total Area:		3,990,062	18,176	\$1,279	\$1,317	\$1,356	\$1,397

** Note: "1" in Size column refers to a lump sum or percentage that are one time costs
** Assume current regulations/no new costs

Assumption: Inflation at 3%
Discount rate for NPV: 5%

Data from CVRWQCB

Central Valley Staff Report from October 2002 (from RWQCB)

Approximate number of dairies in Central Valley Region:

1700

Average-sized dairy in the Central Valley Region:

750 cows

Personal communication with Regional Board Staff 3/11/04 and 3/24/04 on surface area of corrals, milk barns and retention ponds at 23 random dairies in the Central Valley.

County	# Mature Cows	Freestall Total Square Footage	Corral Total Square Footage	Freestall + Corral Total Square Footage	Freestall + Corral Average Square Footage Per Cow	Retention Pond Total Square Footage	Retention Pond Average Square Footage Per Cow	Milk Parlor/Barn Total Square Footage	Milk Parlor/Barn Average Square Footage Per Cow
		Total	Total	Total	avg/cow	total	avg/cow	total	avg/cow
Fresno	7,200	2,614,000	3,790,000	6,404,000	889	8,590,333	1,193	86,000	12
Glenn	450	111,600	86,940	198,540	441	26,000	58	5,616	12
Glenn	2,400	288,000	712,500	1,000,500	417	222,875	93	18,500	8
Kern	4,100	0	5,253,500	5,253,500	1,281	1,353,552	330	37,000	9
Kern	7,200	3,020,000	5,000,000	8,020,000	1,114	1,268,000	176	105,000	15
Kings	540	57,400	296,425	353,825	655	58,900	109	4,750	9
Kings	3,450	614,840	2,604,340	3,219,180	933	579,498	168	10,400	3
Kings	645	0	343,540	343,540	533	36,225	56	2,250	3
Kings	1,800	176,400	959,728	1,136,128	631	566,448	315	10,700	6
Madera	5,100	1,498,000	2,178,000	3,676,000	721	1,995,143	391	31,500	6
Merced	2,760	326,840	900,912	1,227,752	445	333,500	121	49,400	18
Merced	2,400	216,000	432,000	648,000	270	210,000	88	17,000	7
Merced	536	58,900	371,800	430,700	804	242,352	452	6,850	13
Merced	3,680	455,000	1,995,000	2,450,000	666	439,972	120	40,000	11
Merced	2,300	1,421,400	3,048,000	4,469,400	1,943	729,500	317	30,000	13
Merced	600	38,716	73,486	112,202	187	165,416	276	3,000	5
San Joaquin	837	128,000	267,200	395,200	472	96,000	115	8,000	10
Solano	2,100	807,100	750,000	1,557,100	741	900,000	429	175,000	83
Stanislaus	2,400	546,890	305,292	852,182	355	444,015	185	21,050	9
Tulare	6,000	0	6,567,000	6,567,000	1,095	751,300	125	42,872	7
Tulare	1,780	120,000	1,012,950	1,132,950	636	366,025	206	7,875	4
Tulare	1,250	0	497,870	497,870	398	374,666	300	10,575	8
Tulare	388	0	641,150	641,150	1,652	108,000	278	3,000	8
Total	59,916	12,499,086	38,087,633	50,586,719	17,280	19,857,720	5,900	726,338	279
Average for 23 dairies sampled:					751		257		12
Size for Average-Sized Dairy of 750 Cows:					563,494 sf 13 Acres	192,401 sf 4.4 Acres		9,087 sf	